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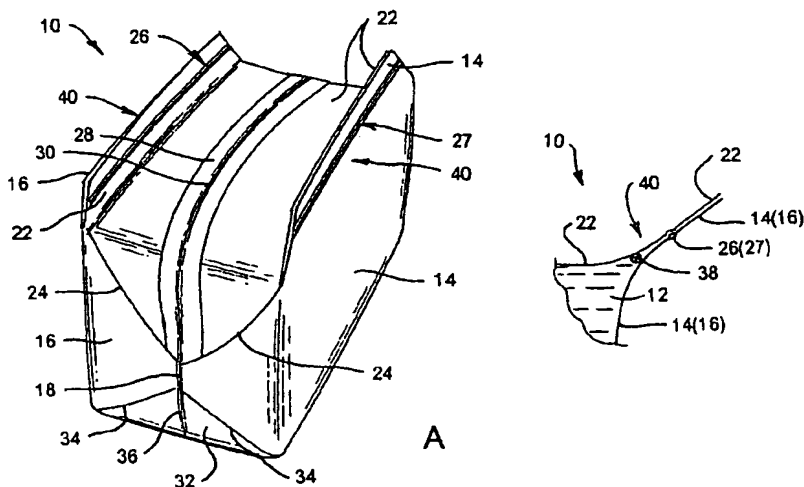
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(54) Title: PACKAGE



(57) Abstract: A package (10) for a flowable material such as rice is made of four sheets of plastics material (14, 16, 22, 32) which are heat welded together along edge regions (18, 20, 24, 34) to form a bag. Two sheets (14, 16) forming sides of the bag together with a top sheet (22) define projections (4) of the bag via which apertures may be formed for access to the bag interior for filling the bag, or for emptying a filled bag. The provision of two projections (4) gives the bag increased versatility compared to prior art bags. The bag may include a strap handle (28) which extends across the top of the bag and is manufactured as a removable laminated portion of the top sheet (22) such that the strap handle (28) is formed during manufacture of the bag instead of being attached in an additional post-manufacture step. A method of manufacture is also disclosed and claimed.

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PACKAGE

Technical Field

The present invention relates to a package for a flowable material. It also
5 relates to a method for manufacturing such a package. The types of flowable
material that may be packaged by the invention include liquids or solids,
although the package is particularly suitable for granular or particulate materials
such as rice or other foodstuffs, pharmaceuticals, powdered detergents, and the
like.

10

Background

Packages for flowable materials which are constructed from sheets of plastics
material or other flexible sheets are known. Thus it is known to construct a
package from a tubular form of plastics material which is cut, folded and sealed
15 to provide bottom and top surfaces of the package. Such a construction
involves relatively complex manufacturing steps. It is also known to form a bag
from discrete sheets of plastics material which are heat-welded together. The
provision of a handle and a pouring aid structure on such a bag is also known.
This bag is of relatively limited versatility and because of its differing handle and
20 pouring aid structures, also relatively complex to manufacture.

The present invention seeks to provide an alternative package which is easy to
manufacture and versatile to use. The invention includes a method of
manufacturing such a package.

25

Disclosure of the Invention

According to a first aspect of the invention there is provided a package for a
flowable material comprising

a plurality of sheets of flexible material which are joined together along
30 edge regions of the sheets to form a bag,

wherein two of the sheets are oppositely located and joined to provide
sides for the bag,

a third sheet is joined to said two sheets to provide a top for the bag, and

a fourth sheet is joined to said two sheets to provide a bottom for the bag,

wherein said two sheets each include an extended portion which together with the third sheet define projections of the bag which extend along at least a portion of a length of the bag,

wherein an aperture may be formed via either projection for access to the bag interior for filling the bag with a flowable material, or for emptying a flowable material from a filled bag with the other projection providing a handle.

A package according to the invention provides a high degree of versatility in that either one or both of the projections of the bag may be utilised for gaining access to the bag interior, for example for filling a bag with a flowable material, after which the sheets forming the one or two projections that have been so utilised may be joined or re-joined to provide a closed or sealed package of the flowable material. The fact that such filling is via one or both projections has the added advantage that the integrity of the substantive bag structure which is to contain the packaged flowable material is not disturbed. Either one of the two projections of the bag may also be utilised to provide an outlet or spout for emptying a filled package with the other projection providing a convenient handhold to assist in manually manipulating the filled bag for pouring out its contents.

Preferably the two projections are substantially identical in shape and more preferably each tapers outwardly of the bag to a lesser length than the length of the bag. The identity of the two projecting parts reduces manufacturing complexity, (that is, symmetrical as opposed to non-symmetrical parts are used) and the tapered format for the projecting parts allows an improved pouring spout to be formed.

The invention encompasses both projections extending to a respective join between the third (top forming) sheet and a respective one of the first (side forming) sheets in which case either one or both of the joins will have to be broken or cut to form said aperture.

Preferably at least one of the projections extends to a join in the form of a releasable closure arrangement, in which case the join can be released to form said aperture.

- 5 Preferably a package according to the invention additionally includes a strap handle for the bag which preferably extends across the third (top forming) sheet. This handle is particularly convenient for carrying a package filled with a flowable material. It may also be used for manually manipulating the bag for emptying it, particularly if both projections are utilised to provide two pouring
10 spouts as may be done for more rapid emptying of the bag.

- Preferably the plurality of sheets of flexible material are of plastics materials and are joined together along edge regions thereof by heat-welding to provide the bag. Such a package of plastics material is relatively straight-forward and
15 economical to manufacture and provides a light-weight, yet robust bag. The provision of projections for such a package according to the invention has the advantage that after the bag has been filled via an aperture in one or in both projections, a vacuum may be readily applied via the projection(s) and the projection(s) then easily sealed. Thus this embodiment of the invention is
20 particularly advantageous for the vacuum packaging of a product such as, for example, rice.

- Even more preferably one of the projections extends to a join provided by a releasable closure arrangement between the third (top forming) sheet and one
25 of the first (side forming) sheets. Suitable structures for such releasable closures between plastic sheets are known. This better facilitates the provision of an aperture for filling the bag. It also advantageously allows the provision of a re-closure means, that is, this projection after applying a vacuum to the bag, may be sealed by heat-welding outwardly of the releasable closure structure.
30 When the bag is re-opened for dispensing its contents by destroying this seal, the releasable closure structure is retained to allow temporary re-closure of the package after some of its contents have been dispensed.

Clearly, for the invention to provide a vacuum package, the plastics sheets need to be impervious and heat-sealable so that the bag will be sealed against outside air and moisture. Suitable plastics materials for the sheets will be known by persons skilled in the art and generally include polyvinyl acetate, polyethylene, polyamide, polyvinyl chloride, polypropylene, polyester or copolymers or mixtures of these compounds.

For an embodiment of the invention formed from plastics sheets, one or more of the plurality of sheets may be a multi-layer laminate, for example at least a support layer and a heat sealable layer may be provided. Additional layers for the laminate sheets may be provided as necessary, depending upon the conferral of desired properties or to facilitate manufacture or for compatibility with the flowable material to be packaged within the bag.

Preferably, for a package according to the invention which is made up of a plurality of plastics sheets, the strap handle (described as a preferred feature hereinbefore) is formed as a laminate portion of the third (top forming) sheet.

Accordingly, the invention in a second aspect provides a method of manufacturing a package for a flowable material, wherein the package is formed from four flexible plastics sheets which are joined together along edge regions of the sheets to form a bag, the bag including a strap handle, the method including

- (i) forming one of the sheets as a laminate that includes a strip that is separable from the laminate to leave a relatively wide shallow groove in said one sheet,
- (ii) assembling said one sheet with the other three sheets and heat-welding the sheets together to form the bag, and
- (iii) separating said strip from said one sheet to provide said strap handle, wherein the strap is bonded to the bag via the heat welds of step (ii).

Forming the strap handle as portion of preferably the third (top forming) sheet prior to forming the bag of the package saves production costs (compared to attaching a discrete strap handle after formation of the bag) in that a continuous

("one pipeline") manufacturing method is facilitated for the package as a whole. It also results in a strong handle that is tightly bonded to the bag to allow lifting of relatively heavy weights of fluid or flowable solid contents of the bag.

5 Although the most preferred form of the invention is a package made from a plurality of plastics sheets, other materials such as sacking or cloth may alternatively be used, and the joining of the sheets may include use of adhesives or stitching.

10 The invention includes a package wherein the bag contains or is filled with a flowable material, preferably a foodstuff such as rice.

Thus it is to be understood that the term "package" as used herein is intended to encompass an empty bag as well as a bag that contains a flowable material.

15

The bag provided by the invention, particularly for a vacuumed package, can be shaped such that the resultant package is of rectangular parallelepiped or cuboid shape. This facilitates storage of the package, that is, it is readily stackable on any of its faces.

20

For a better understanding of the invention and to show how it may be carried into effect, preferred embodiments thereof will now be described, by way of non-limiting example only, with reference to the accompanying drawings.

25 **Brief Description of the Drawings**

Fig. 1A shows a package according to an embodiment of the invention, namely a bag filled with a flowable material.

Fig. 1B is a schematic cross-section of portion of the package of Fig. 1, illustrating a projection thereof.

30 Fig. 2 shows a package according to an embodiment of the invention, namely an empty bag.

Fig. 3 schematically illustrates the structure of the third (top forming) sheet of a package as in Fig. 1 or Fig. 2.

Fig. 4A schematically illustrates a continuous manufacturing line for packages as shown by Fig. 2.

Fig. 4B is a schematic diagram to help explain the Fig. 4A arrangement.

Fig. 4C shows the arrangement of sheets during the manufacture of a
5 bag as in Fig. 4A.

Fig. 5 schematically illustrates the bonding of the strap handle to the bag.

Detailed Description of Preferred Embodiments

The terms "top", "bottom", "sides", "inward", "outward", and like terms which describe locations, orientations or directions, as used throughout this
10 specification, are used with respect to the orientation of a package 10 as depicted in Fig. 1A. It will be understood that the package 10 may be placed in orientations other than that which is depicted and thus the terms in question such as "top", "bottom", "sides", etc., are not to be construed as limiting in the sense of restricting the orientation of the package to that as depicted in Fig. 1A.
15 For example, the terms in question as used in respect of Fig. 2, although not literally correct, can be readily understood given the Fig. 1A illustration.

The invention encompasses a package 10 which is filled with a flowable material 12 (see Fig. 1B) such as rice, and has been vacuumed to provide a
20 package 10 that has a generally rectangular parallelepiped shape. It also encompasses a package 10 in the form of an empty bag (see Fig. 2), which is generally in a flattened condition such as it emerges from a continuous production line. Generally the bag 10 of the package is manufactured by welding two inward V folded sheets between two other sheets, wherein the
25 inwardly folded sheets form the top and bottom of the bag and the two other sheets form the sides of the bag.

Specifically, the package or bag 10 of Fig. 1A or Fig. 2 is made up of two side forming sheets 14, 16 of flexible plastics material which are oppositely located
30 and joined by heat-welding along opposite edge regions thereby forming heat seal weld seams 18, 20 (seam 20 is not visible in Fig. 1A, being located along the hidden end of the package). A third plastics sheet 22 is joined to the two side sheets 14, 16 at side weld seams 24 and for one of the side sheets 16, a top weld seam 26 (along edge regions of the sheets). The third plastics sheet

22 is joined to the other side sheet 14 via a releasable closure structure 27, which comprises a pair of interlocking strips respectively including complementary male and female formations, which strips are respectively attached to the sheets 22 and 14. Such strip type closure structures are well known and thus not described in any further detail herein. The sheet 22 joined to the sheets 14 and 16 provides a top for the bag (as shown by Fig. 1A). The third (top forming) sheet 22 includes a strap handle 28 formed as a laminate portion of the third sheet 22 prior to forming the bag 10, as described in more detail hereinbelow.

10

Fig. 2 shows the third (top forming) sheet 22 as being inwardly V-folded and located between sheets 14 and 16, the fold line being shown by the reference 30. A fourth plastics sheet 32 is joined to the two side sheets 14 and 16 at heat-weld seams 34, along edge regions of the sheets, to provide a bottom for the bag (as shown by Fig. 1A). Fig. 2 shows that the fourth (bottom forming) sheet 32 is inwardly V-folded and located between sheets 14 and 16, the fold line being shown by reference 36.

Each of the side sheets 14 and 16 includes an extended portion 38 (best seen in Fig. 1B), which together with the top forming sheet 22 define projections 40 which extend along the bag to the side weld seams 24 and extend outwardly of the bag 10 respectively to the top weld seam 26 and the closure structure 27. It will be evident from the figures that the sheets 14 and 16 are each shaped as an eight-sided polygon which is symmetrical about a centre line between two opposite sides of the polygon (which opposite sides are where the weld seams 18 and 20 are formed), and which opposite sides are substantially parallel, are relatively short and are relatively widely spaced for forming the bag length. The extended portion 38 provides a greater area on one side of another line passing through the centre of these opposite sides than on the other side thereof. The third (top forming) sheet 22 is similarly shaped as an eight-sided polygon which is symmetrical about a centre line between two opposite sides of the polygon, which opposite sides are substantially parallel, are relatively short and are relatively widely spaced as for the sheets 14 and 16. The fourth (bottom forming) sheet 32 is shaped as a six-sided polygon having two long parallel

sides for forming the bag length, wherein the distance between the two long parallel sides substantially defines a width for the bag.

5 The projections 40 provide a convenient means for gaining access to the interior of an unfilled bag 10 as shown in Fig. 2. In particular, the closure structure 27 may be released to provide an aperture for filling the bag 10 after which the projection 40 containing this closure structure 27 may be heat-welded outwardly of the closure structure 27 (after applying a vacuum to the bag) to seal the package 10. The bag may then be opened by destroying this outer seal and the closure structure 27 then released to allow the package contents to be dispensed, for example by pouring from the projection which acts as a spout. The retention of the closure structure 27 allows the package 10 to be temporarily re-closed until such time as a further portion of its contents is to be dispensed.

15 Fig. 1B illustrates that the projections 40 extend in one case to the weld seam 26 and for the other to the releasable closure structure 27. Once either or both of the joins 26 or 27 are breached, the bag interior becomes accessible either for filling with material 12 or for emptying material 12 from the bag 10.

20 With reference to Fig. 3, the third (top forming) sheet 22 incorporating strap handle 28 is a multi-layer laminate formed from three sheets 42, 44, 46. The total thickness of sheet 42 is 98 μm and it consists of three layers (not shown). The top layer is made of nylon, which is 15 μm thick. The second layer is made of polyethylene (PE), which is 50 μm thick. The top layer is adhered (laminated) to the second layer by a 3 μm layer of glue. The bottom surface of the top layer and the top surface of the second layer are corona treated (to produce "holes" on the surface of the layer to ensure good lamination) before they are glued together. These two (top and second) layers comprise the strap handle 28 of the bag 10. The bottom layer is made of PE and is 30 μm thick. The bottom surface of the second layer and the top surface of the bottom layer are not corona treated (and therefore they do not facilitate lamination and allow easy detachment of the strap handle 28 after manufacture, for facilitating heat sealing at the heat sealed edges 18, 20, 24 of the bag 10). Glue applied to the bottom

surface of the second layer is applied to the longitudinal edges only to facilitate detachment of the strap handle 28 after sealing of the bag 10.

5 The total thickness of sheet 44 is 98 μm and it consists of two layers (not shown). The top layer is made of nylon, which is 15 μm thick. The bottom layer is made of PE, which is 80 μm thick. The top layer is adhered to the bottom layer by a 3 μm layer of glue. Again, the bottom surface of the top layer and the top surface of the bottom layer are corona treated before lamination so that they are firmly glued (laminated) together.

10

The total thickness of sheet 46 is 83 μm . Sheet 46 is made of PE, which is 80 μm thick. The top surface of the layer is corona treated and spread with a 3 μm thick layer of glue.

15 Manufacture of the third (top forming) sheet 22 can be done in one assembly line. Each sheet 42, 44, 46 is in a roll to start with. First, sheet 44 (a continuous sheet before being cut into three parts) is pulled out and it goes through a cutter, which cuts it into three parts. The width of the centre part is the same as the strap handle 28 of the bag 10. The centre part of sheet 44 is
20 then pulled away. Sheet 42 is pulled out at the same time as sheet 44 in the same direction. Sheet 42, which mainly comprises the strap handle 28, replaces the "pulled away" centre part of sheet 44. Since sheet 42 and sheet 44 have the same thickness, the thickness of the combined layer (sheet 42 and sheet 44) is uniform. The combined layer consists of two sheets of sheet 44 on
25 the left and the right respectively of sheet 42 in the middle.

Sheet 46, which has the same width as the original sheet 44, is pulled out and goes under the combined layer of sheet 42 and sheet 44 and they are glued (laminated) together by a layer of glue. Again, the bottom of the combined layer
30 and the top of sheet 46 are corona treated to facilitate lamination.

The product that emerges from the assembly line is the (top forming) sheet 22. Its thickness is uniform over the surface. The strap handle 28, which is the top and second layer of sheet 42, is detachable from the third (top forming) sheet

22 leaving a relatively wide shallow groove. The bottom layer (not detached) of sheet 42 remains adhered to sheet 46.

5 With reference to Fig. 4A, a manufacturing line for a bag package 10 involves unrolling the side facing sheets 14 and 16 from respective rolls 50, 52, feeding top forming sheet 22 therebetween from a roll 54 and feeding bottom forming sheet 32 therebetween from the opposite side from a roll 56. The top forming sheet 22 and bottom forming sheet 32 are respectively folded by known means before the heat welds are formed. Fig. 4B schematically illustrates the arrangement showing sheets 22 and 32 between sheets 14 and 16 and being folded at the fold lines 30 and 36.

15 The sheets are then joined by applying a hot press to form the respective heat welds 18, 20, 24, 26 and 34 as the assembly is moved downstream. Instead of forming a heat weld 26 on each projection 40, the respective complementary strips (not shown) of a releasable closure structure 27 may be attached to the respective sheets 22 and 14 to join those sheets for one of the projections 40. The final manufacturing step is cutting to remove the portions labelled 58 and to divide the individual bags 10.

20 Fig. 4C illustrates the assembly of the sheets 14, 16, 22 and 32 from rolls 50, 52, 54 and 56 in more detail.

25 The above described prior manufacture of the strap handle 28 as part of the third (top forming) sheet 22 and its consequent incorporation on the bag 10 as part of the bag 10 manufacturing process results in a strap handle that is securely bonded to the bag (to enable frequent lifting of a heavy bag without breaking the strap handle) with a streamlined (low cost and efficient) production line. Thus the strap handle is produced automatically during the manufacturing of the bag, in contrast to having to attach a separate strap handle to a manufactured bag in a post manufacturing step.

Fig. 5 schematically illustrates the bonding of the strap handle 28 to the bag 10. This figure (which is clearly not to scale, being merely schematic) represents a

side edge region where the handle 28 is bonded via heat welds 24 adjacent the heat welds 18 and 20. The strap handle is made up of layers labelled 60 and 62 which as described hereinbefore are respectively a 15 μm nylon layer and 50 μm PE layer, which are laminated together with a 3 μm layer of glue. A third
5 layer 66 is the 30 μm layer of PE with the three layers 60, 62 and 66 being the layers of sheet 42 of Fig. 3. The next layer is the sheet 46 of Fig. 3, that is an 80 μm thick layer of PE which is laminated to layer 66 by a 3 μm layer of glue 68. The heat welding to a side sheet 14 or 16 forms heat welds between layers 62 and 66 (see reference 70) and layers 46 and 14 (16) (see reference 71).
10 Thus the bonding of the strap handle 28 is by lamination and by heat welding. The interface between layers 62 and 66 is not corona treated such that in the non-bonded portions detachment of the strap handle 28 will be facilitated, but ensures good heat sealing of the strap handle 28 to the bag 10 at the heat sealed regions 24.

15

The invention described herein is susceptible to variations, modifications and/or additions other than those specifically described and it is to be understood that the invention includes all such variations, modifications and/or additions which fall within the scope of the following claims.

20

CLAIMS

1. A package for a flowable material comprising
a plurality of sheets of flexible material which are joined together along
5 edge regions of the sheets to form a bag,
wherein two of the sheets are oppositely located and joined to provide
sides for the bag,
a third sheet is joined to said two sheets to provide a top for the bag, and
a fourth sheet is joined to said two sheets to provide a bottom for the
10 bag,
wherein said two sheets each include an extended portion which
together with the third sheet define projections of the bag which extend along at
least a portion of a length of the bag,
wherein an aperture may be formed via either projection for access to the
15 bag interior for filling the bag with a flowable material, or for emptying a flowable
material from a filled bag with the other projection providing a handle.
2. A package as claimed in claim 1 wherein each projection extends
outwardly to a join between the third sheet and one of said first sheets.
20
3. A package as claimed in claim 2 wherein the join between the third sheet
and one of said first sheets of at least one projection is provided by a releasable
closure arrangement for the join to be released to form said aperture.
- 25 4. A package as claimed in any one of claims 1 to 3 wherein the projections
are substantially identical.
5. A package as claimed in claim 4 wherein the projections extend along
the whole length of the bag and taper outwardly thereof to a lesser length.
30
6. A package as claimed in any one of claims 1 to 5 wherein the plurality of
sheets are of plastics materials and are joined together by heat welding.

7. A package as claimed in claim 6 wherein the plastics sheets are laminated multi-layer sheets.

8. A package as claimed in claim 6 or claim 7 as appended to claim 3,
5 wherein the releasable closure arrangement comprises a pair of interlocking strips respectively including complementary male and female formations, wherein one strip is attached to the third sheet and the other strip is attached to one of said first sheets.

10 9. A package as claimed in any one of claims 6 to 8 wherein the bag includes a strap handle which extends across the third (top forming) sheet.

10. A package as claimed in claim 9 wherein the third (top forming) sheet is a multi-layer laminate and the strap handle is a laminate portion of the third
15 sheet.

11. A package as claimed in claim 10 wherein the third sheet is a laminate of at least three layers and the strap handle is a laminate portion comprising two
20 layers.

12. A package as claimed in claim 11 wherein the outermost layer of the third sheet and thus of the strap handle is a plastics material of higher strength than the other layers.

25 13. A package as claimed in claim 12 wherein said outermost layer is nylon.

14. A package as claimed in any one of claims 1 to 13 wherein each of said two of the sheets (the side forming sheets) are shaped as an eight-sided polygon which is symmetrical about a centre line between two opposite sides of
30 the polygon, which opposite sides are substantially parallel, are relatively short and are relatively widely spaced for forming the bag length, and wherein said extended portion defines a greater area on one side of another line passing through the centres of said opposite sides than on the other side thereof.

15. A package as claimed in any one of claims 1 to 14 wherein the third (top forming) sheet is shaped as an eight-sided polygon which is symmetrical about a centre line between two opposite sides of the polygon which opposite sides are substantially parallel, are relatively short and are relatively widely spaced for forming the bag length.

16. A package as claimed in any one of claims 1 to 15 wherein the fourth (bottom forming) sheet is shaped as a six sided polygon having two long parallel sides for forming the bag length, wherein the distance between the two long parallel sides substantially defines a width for the bag.

17. A package as claimed in any one of claims 1 to 16 wherein the bag contains a flowable material.

18. A package as claimed in claim 17 wherein the bag is formed from sheets of plastics material and is vacuumed and sealed.

19. A package as claimed in claim 18 wherein the vacuumed sealed bag containing the flowable material is shaped substantially as a rectangular parallelepiped.

20. A package as claimed in any one of claims 17 to 19 wherein the flowable material is rice.

21. A method of manufacturing a package for a flowable material, wherein the package is formed from four flexible plastics sheets which are joined together along edge regions of the sheets to form a bag, the bag including a strap handle, the method including

(i) forming one of the sheets as a laminate that includes a strip that is separable from the laminate to leave a relatively wide shallow groove in said one sheet,

(ii) assembling said one sheet with the other three sheets and heat-welding the sheets together to form the bag, and

(iii) separating said strip from said one sheet to provide said strap handle, wherein the strap handle is bonded to the bag via the heat welds of step (ii).

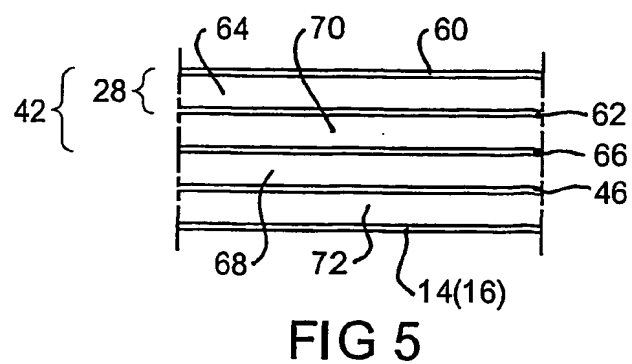
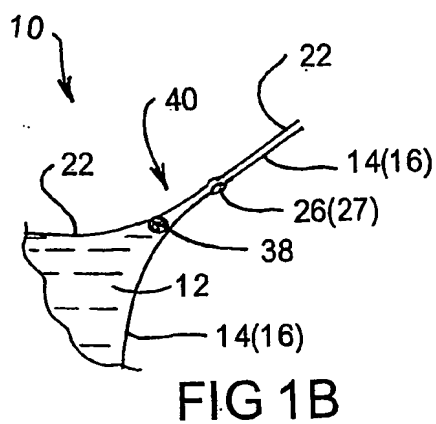
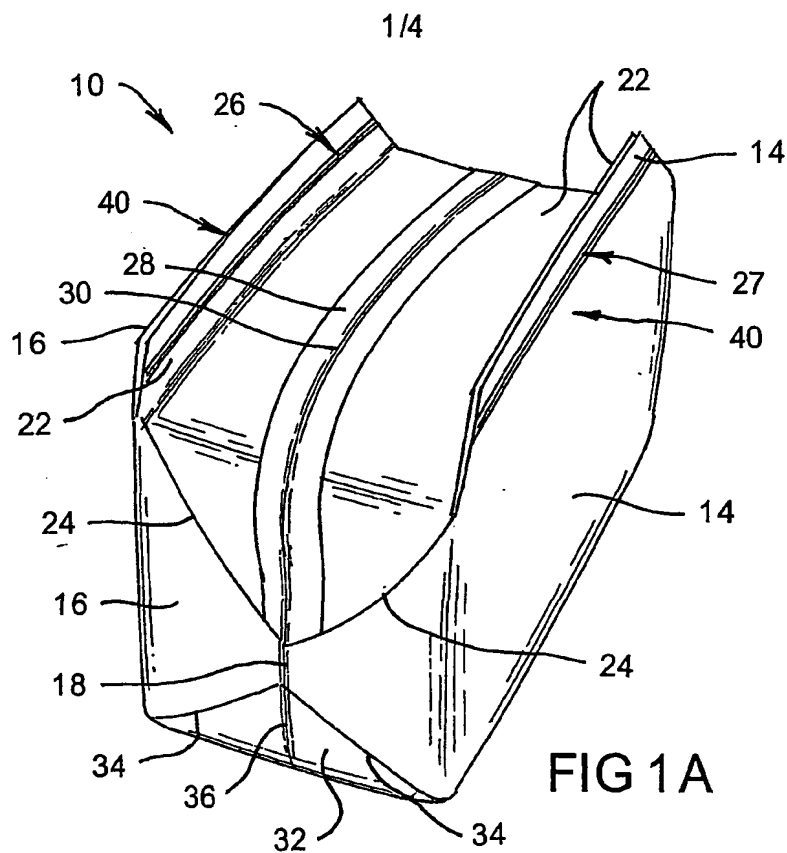
5 22. A method as claimed in claim 21 wherein said one of the sheets formed as a laminate is formed to provide a top for the bag.

23. A method as claimed in claim 21 or claim 22 including forming said one sheet as a laminate of at least 3 layers and forming said strip as a laminate of at
10 least two layers.

24. A method as claimed in claim 23 including laminating said one sheet and said strip thereof such that the sheet including the strip is of uniform thickness.

15 25. A method as claimed in any one of claims 21 to 24 including locating said strip substantially centrally of said one sheet.

26. A package as manufactured by a method as claimed in any one of claims 21 to 24.



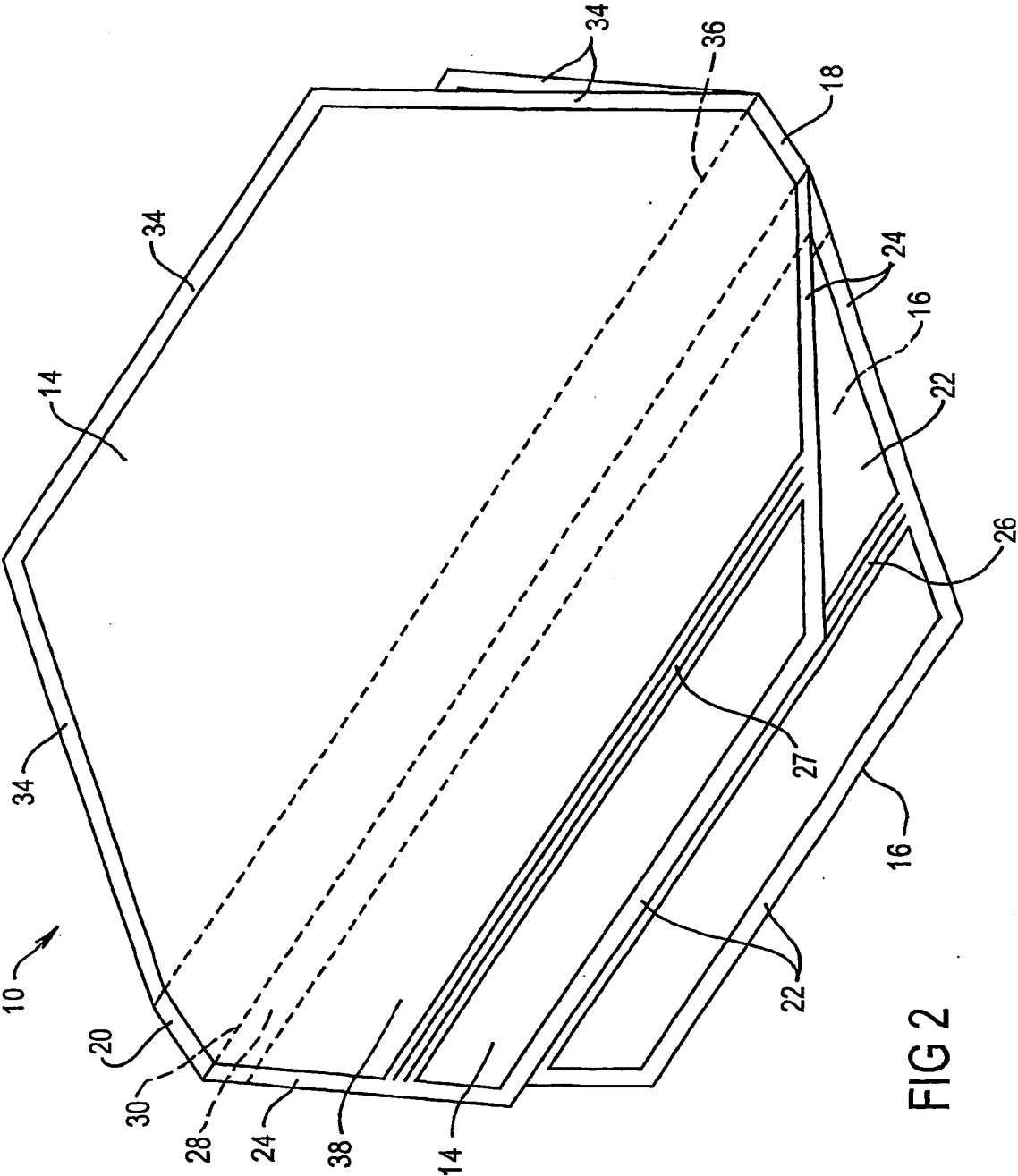


FIG 2

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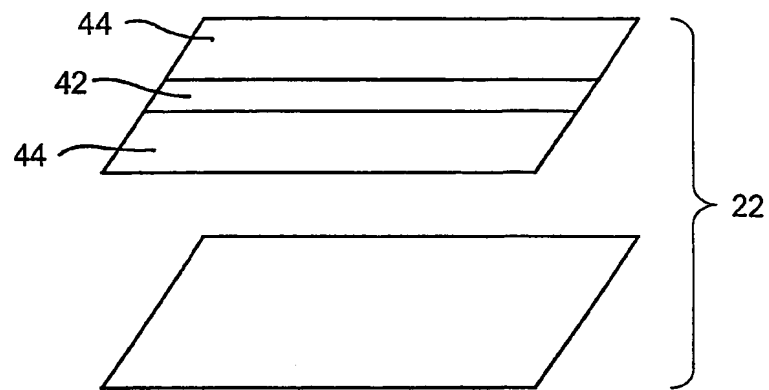


FIG 3

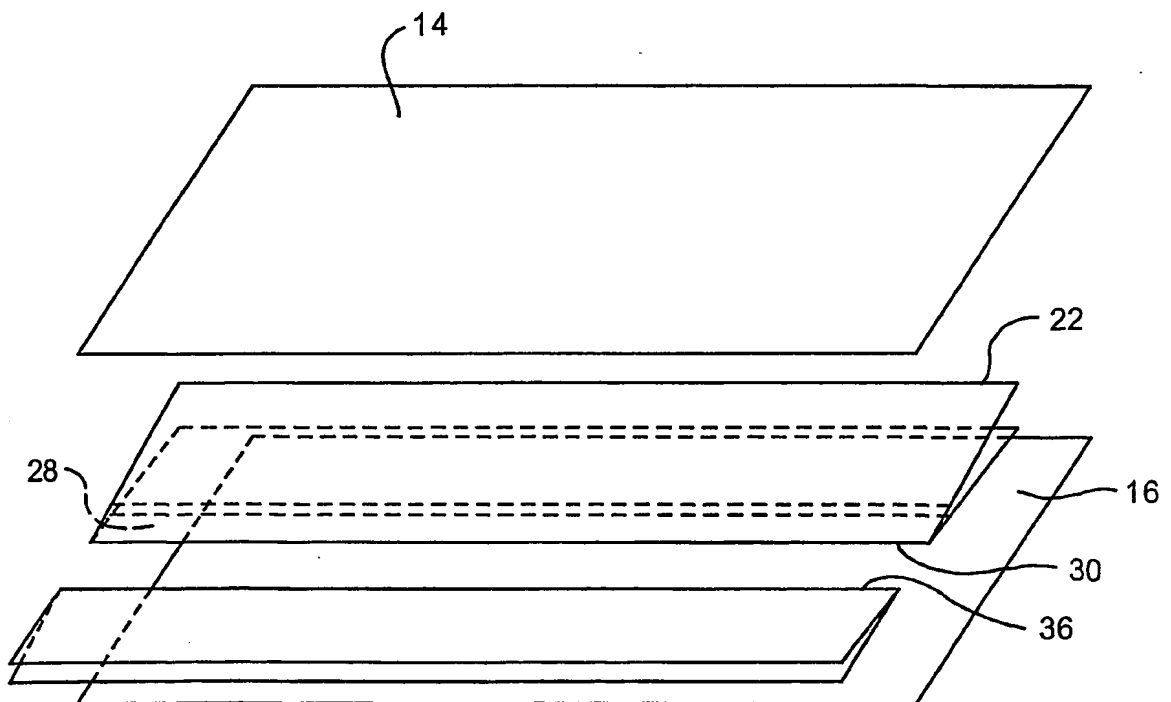
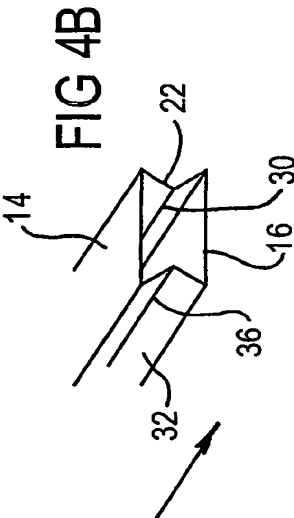
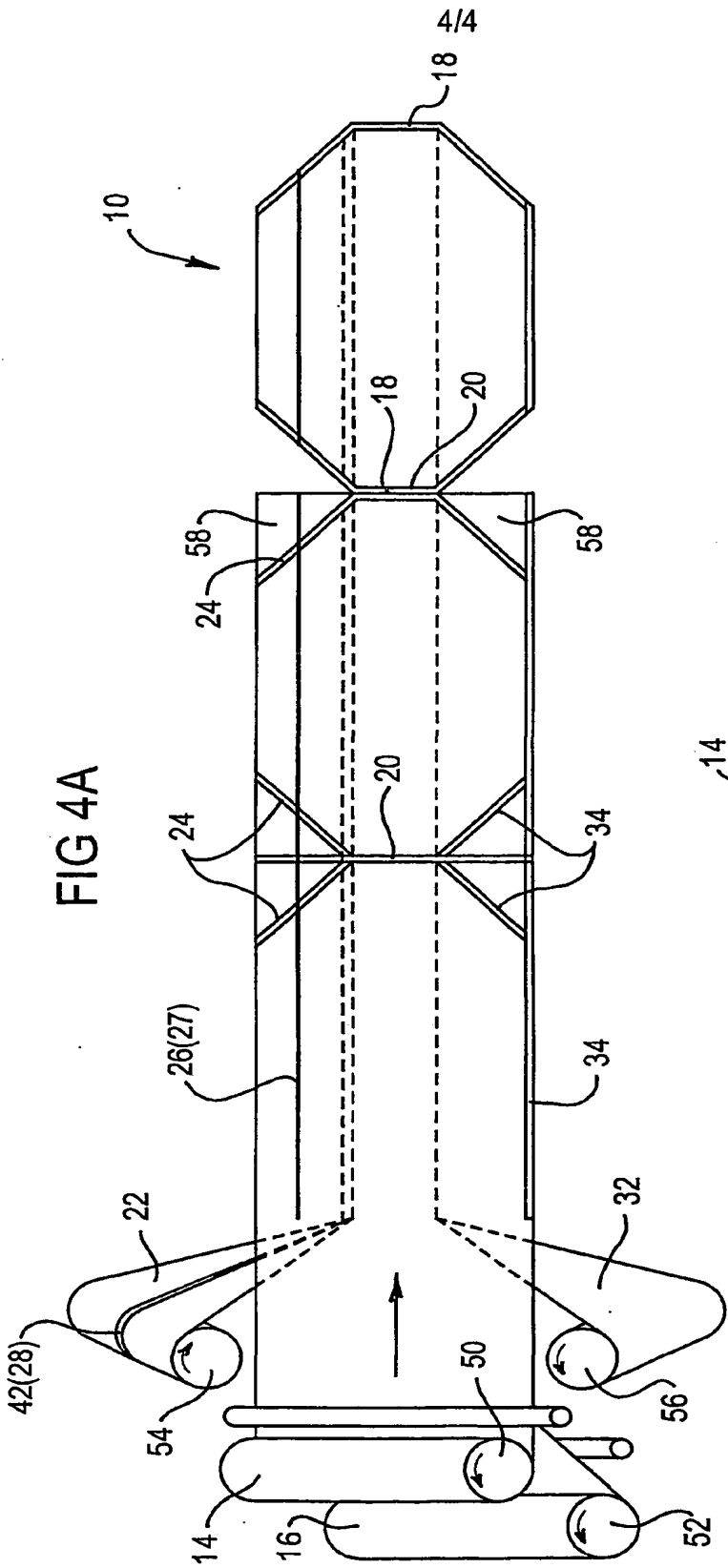


FIG 4C

SUBSTITUTE SHEET (RULE 26) RO/AU



INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU02/00057

A. CLASSIFICATION OF SUBJECT MATTERInt. Cl. ⁷: B65D 30/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

ELECTRONIC SEARCH AS BELOW

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI and IPC: B65D, B65B and keywords (bag, sack, package, sheet, film, web, layer, weld, heat, seam, seal, projection, protrusion, wing, tongue, aperture, hole, opening, orifice, handle, holder, strap, grip, flexible and similar words).

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 10119991 A (TOPPAN PRINTING CO LTD) 12 May 1998 JP 10119991 A (TOPPAN PRINTING CO LTD) 12 May 1998 (abstract). [online] [retrieved on 7/03/2002]. Retrieved from: Espacenet See figures 1-4 and abstract	1-26
A	US 4576285 A (GOGGIO) 18 March 1986 See figures 1-3	1-26
A	US 4316574 A (LEPISTO) 23 February 1982 See figure 2	1-26

☒ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 8 March 2002	Date of mailing of the international search report 12 2 MAR 2002
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929	Authorized officer DEREK BUTLER Telephone No : (02) 6283 2347

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU02/00057

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0118112 B (NORSK HYDRO A/S) 12 July 1989 See figures 1-4	1-26
A	US 4721396 A (SENGEWALD) 26 January 1988 See figures 1-12	1-26
A	US 4890934 A (FEAVER et al) 2 January 1990 See figures 1-3	1-26

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU02/00057

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
JP	10119991	NONE			
US	4576285	EP	129326	US	4518087
		US	4705174	US	4667453
US	4316574	NONE			
EP	118112	AU	24687/84	BR	8401008
		DK	1348/84	ES	529873
		FI	840763	HK	1192/93
		NO	830718	NZ	207325
		PT	78164	SU	1574165
		US	4832506	NO	920426
US	4721396	CA	1257569	DE	3508123
US	4890934	AU	24505/88	BR	8805596
		EP	314247	HK	994/96
		NZ	226765	PH	25630
END OF ANNEX					